

NOT PRINT-)
IDE

ces a 44"x44" presentation
research poster and save
text, and graphics.

that will guide you
answer your poster
template tutorials, go online
on HELP DESK.

er, go online to

3001

ART

out

om in and out to the level
ou. Go to VIEW > ZOOM.

Affiliations

title, the names of the
can type or paste text into
omatically adjust the size of
ually override this feature and

bigger than your name(s) and

Seals

f the title. You can insert a
desktop, copy and paste or
n from web sites are likely to
00% to see what the logo will
necessary adjustments.

on our free poster templates

graphics

ing from your desktop, copy
ES. Resize images
key and dragging one of the
poster, do not distort your
K.

Check

magnification. If they look good
xelated, you will need to
resolution.



High Speed Streams and Space Weather Forecasting

Mary Aronne¹, Yihua Zheng²

¹University of Maryland, Baltimore County, ²NASA GSFC Code 674



ABSTRACT

The Space Weather Research Center provides experimental research forecasts and analysis for NASA robotics missions operators. Space weather forecasters monitor space weather conditions to provide advance warning and forecasts based on observations and modeling. High speed streams (HSS) are a type of space weather driver involving the high speed component of the solar wind that originates from coronal holes, which can last for many solar rotations. High speed streams produce geomagnetic storms with different source signatures than those of geomagnetic storms caused by coronal mass ejections (CMEs). Coronal mass ejections are studied extensively and are well known for producing strong geomagnetic storms and impacting Earth's radiation belts. High speed streams pump energy into the Earth's magnetosphere for a longer period of time than that of a flux rope, producing energetic electron flux enhancement in Earth's outer radiation belt (near geosynchronous orbit) and prolonged substorm activity. It is important to understand high speed streams as a driver of space weather activity due to the energetic electron enhancement that can impact spacecraft in the near-Earth environment. This project will focus on the high speed stream events on June 8, 2015, July 4, 2015, and July 10, 2015, in order to understand the different arrival signatures, impacts on electron flux enhancement, and development of geomagnetic storms from high speed streams.

BACKGROUND

High speed streams are associated with the high speed solar wind that originates from coronal holes

Coronal holes are regions with open magnetic fields and are commonly found at the poles

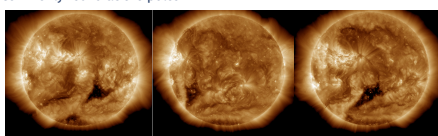


Figure 1. A coronal hole lasting one solar rotation was responsible for high speed streams on June 8, 2015 and July 4, 2015.

Stream interaction regions (SIRs) are found at the compressed boundary of high and low speed solar wind.

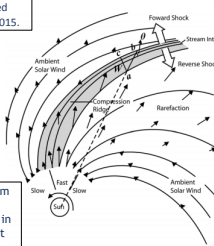


Figure 2. A 2-D diagram of a stream interaction region is shown in the gray area. It is wound less tightly in the Parker spiral than the ambient solar wind. L.K.Jian et al.

Co-Rotating Interaction Regions (CIRs) is a high speed stream that lasts many solar rotations over a long-lasting coronal hole

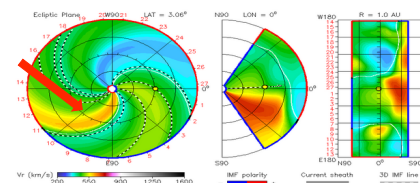


Figure 3. A long-lasting stream interaction region as shown in the WSA-ENLIL cone model by the difference in velocity from the ambient solar wind. Image credit: ISWA

High Speed Streams

- Electron flux enhancement at GEO orbits
- Outer edge radiation belt impact is more prominent
- Weaker, long geomagnetic storms (3-6 days)

VS.

Coronal Mass Ejections

- Radiation belt flux peak more inside GEO orbits
- More magnetic field coupling
- Strong geomagnetic storms

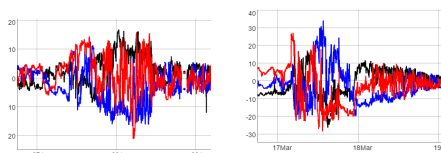


Figure 4. The different source signatures for the June 7th, 2015 High Speed Stream arrival and the March 17th, 2015 CME arrival at ACE image credit: ISWA

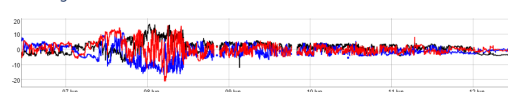
OBSERVED EVENTS and METHODOLOGY

HSS Event: 2015-06-08T00:16Z

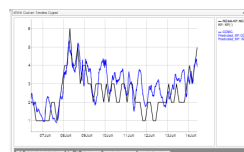
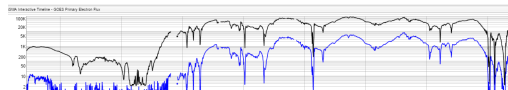
Peak solar wind velocity: 712 km/s



Ace Magnetic Field



GOES electron flux

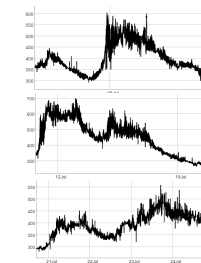


Two days later there was a magnetopause crossing on 2015-06-10

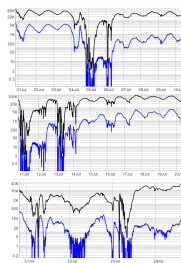
Figure 5. A progression of events from the June 8, 2015 high speed stream event image credit: ISWA

July: A Month of High Speed Stream Activity

Solar wind velocity for three high speed streams as shown at ACE



Electron flux enhancement as measured by GOES



July 4, 2015 and July 10, 2015

July 14, 2015

July 20, 2015

Figure 6. Four high speed stream events in the month of July image credit: ISWA

The Earth's Magnetosphere

Changes in the solar wind (like a HSS) produce electron flux enhancements by adding energy to the Earth's magnetosphere.

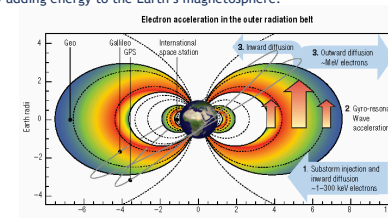
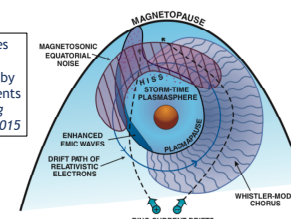


Figure 7. High speed streams accelerate electrons in the outer radiation belt, leading to substorms in the near-Earth environment image credit: Horne et al., 2007, Nature Physics

Figure 8. Various waves in the radiation belt, driven by high speed stream events image credit: Y. Zheng RB/SEP PowerPoint, 2015



FORECASTING HIGH SPEED STREAMS

Short term forecasting of high speed streams can be done by studying the coronal holes on the Sun and their magnetic field structure.

Co-rotating interaction regions can indicate when a coronal hole will rotate onto the Earth-facing solar disk, usually about every 25-27 days.

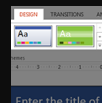
ACKNOWLEDGEMENTS

Mary Aronne would like to thank her mentor, Dr. Yihua Zheng, for her support during this internship, as well as the Community Coordinated Modeling Center (CCMC) and Space Weather Research Center (SWRC) staff.

QUICK

How to change

You can easily change the color
DESIGN menu, click on COLORS
choice. You can also create your



You can also manually change the
VIEW > SLIDE MASTER. After you
go to VIEW > NORMAL to continue

How

The template
formatting
blocks. You
pasting text
from the

Adjust the size of your text based
present. The default template
the conference requirements.

How

To add a table from
TABLE. A default
columns.

You can also copy a
PowerPoint document
formatted by RIGHT-
Margins.

Gr

You can simply copy and paste
Some reformatting may be required
document has been created.

How to change

RIGHT-CLICK on the poster back
column options available for the
be customized on the Master. V

How to re

If you are working in PowerPoint
poster, save as PDF and the back
them by going to VIEW > MASTER
match the Page-Setup in PowerPoint
also delete them from the Slide

Save

Save your template as a PowerPoint
PowerPoint of "Print-quality" P

Print

When you are ready to have your
PosterPresentations.com and click
Choose the poster type the best
If you submit a PowerPoint docu
for your approval prior to printi
before noon, Pacific, Monday th
that same day. Next day, Second
services are offered. Go to Post
information.

